SB 761
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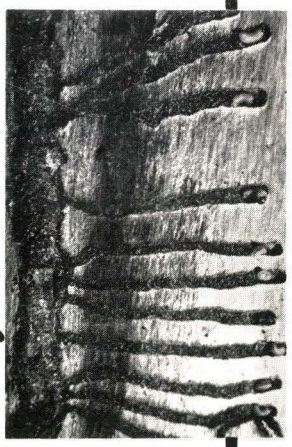
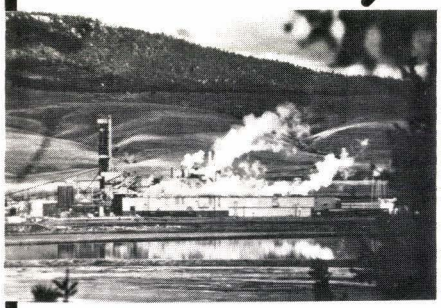
1973

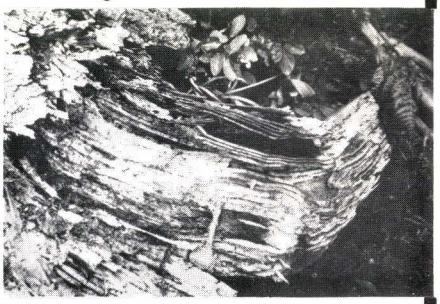
Forest Insect and Disease Conditions

NORTHERN REGION

1973







USDA - FOREST SERVICE NORTHERN REGION
Division of State and Private Forestry

Report No. 74-1

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Cover photo: Death of the tree in the large photo could have been caused by any one of the factors shown in the small photos, starting at the left and reading counterclockwise: tussock moth larva; air pollution; root rot; Douglas-fir beetle larval gallery.

FOREST INSECT AND DISEASE CONDITIONS
NORTHERN REGION
1973

by

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Environmental Services Branch

The authors gratefully acknowledge all Federal, State, and private agencies whose assistance and cooperation made this report possible.

We especially thank the personnel of Environmental Services for their support.

STATUS OF FOREST INSECTS

Conditions in Brief

Western spruce budworm damaged approximately 3.5 million acres of Douglas-fir, true fir, and Engelmann spruce in northern Idaho and Montana. Douglas-fir tussock moth defoliated 104,000 acres of mixed Douglas-fir and true fir in northern Idaho and mixed State and private land near Colville, Washington, and 350 acres of Douglas-fir in western Montana. Larch casebearer caused heavy defoliation of larch at lower elevations in northern Idaho, northwestern Montana, and northeastern Washington. Pine butterfly populations declined on the Bitterroot and Lolo National Forests of Montana and Nezperce National Forest, Idaho. Several thousand acres of Douglas-fir were defoliated by the western false hemlock looper near Bigfork and Somers, Montana. The western hemlock looper infestation increased on the St. Joe and Clearwater National Forests, Idaho.

White pine stands continued to sustain heavy losses by mountain pine beetle on the Clearwater National Forest, Idaho, and new outbreaks occurred in white pine stands on the Colville National Forest in eastern Washington. Infestations in lodgepole pine stands continued to increase on the Gallatin National Forest, Montana, and in Yellowstone National Park, Wyoming. Mountain pine beetle continued to deplete second-growth ponderosa pine stands on the Lolo National Forest, Montana. New infestations developed in lodgepole pine stands on the Helena and Lewis and Clark National Forests, Montana. Several thousand ponderosa pine were killed by mountain pine beetle on the Crow Indian Reservation in southeastern Montana.

Douglas-fir beetle infestations declined for the second consecutive year in the North Fork Clearwater River drainage, Idaho, but increased in the South Fork Clearwater River drainage. Pine engraver beetle infestations increased in second-growth ponderosa pine stands along the Clark Fork River drainage in western Montana, and on the Clearwater National Forest, Idaho. A Douglas-fir engraver beetle top killed Douglas-fir along Dworshak Reservoir near Orofino, Idaho. Western pine beetle killed many groups of ponderosa pine on the Nezperce National Forest, Idaho.

Foliar damage was caused by a complex of defoliators on 5,000 acres of lodgepole pine on the Flathead National Forest and in Glacier National Park, Montana. The Bruce spanworm defoliated more than 15,000 acres of quaking aspen in the Turtle Mountains of North Dakota. A pine sawfly defoliated 10,000 acres of lodgepole and ponderosa pine reproduction in the Kootenai National Forest, Montana. The variable oakleaf caterpillar caused light defoliation of basswood, paper birch, and bur oak in North Dakota. Forest tent caterpillar defoliated hardwood shrubs along stream bottoms in many north Idaho valleys. White pine weevil top killed spruce reproduction throughout the Region. The california tortoise shell butterfly defoliated 1,200 acres of shiny leaf ceanothus near Seeley Lake, Lolo National Forest, Montana, and several hundred acres in the Sundance burn, Idaho Panhandle National Forests.

Major Defoliator Problems

WESTERN SPRUCE BUDWORM, *Choristoneura occidentalis* Free.--Area of western spruce budworm infestation decreased from 4.6 million acres in 1972 to 3.5 million acres in 1973 (fig. 1). Defoliation decreased noticeably on all Forests east of the Continental Divide except on the Lewis and Clark National Forest, Montana, and in Yellowstone National Park, Wyoming (table 1).

Table 1.--Acres of aerially visible western budworm defoliation in Region 1, 1973

Unit	Defoliation (acres) 1972	1973
Idaho		
Nezperce NF	1,342,000	1,321,000
Clearwater NF	397,600	414,680
Idaho Panhandle NF's[1/]	66,500	146,000
Montana		
Lolo NF	1,350,000	931,000
Bitterroot NF	321,000	347,000
Flathead NF	188,000	120,090
Flathead Indian Reservation	195,500	119,560
Deerlodge NF	335,000	78,320
Helena NF	385,000	44,680
Yellowstone National Park	46,000	17,280
Beaverhead NF	21,000	14,500
Gallatin NF	15,260	11,400
Lewis and Clark NF	0	350

1/ Previously St. Joe NF.

A new outbreak with light to moderate defoliation was detected on 9,000 acres in Douglas-fir stands along the Madison River, Beaverhead National Forest, Montana. Infestations decreased in intensity on the east half of the Lolo National Forest and on the Flathead Indian Reservation in Montana.

An impact survey conducted on the Flathead Indian Reservation showed that most of the grand fir and alpine fir and 13.8 percent of the Douglas-fir were top killed in the Valley Creek drainage west of Arlee, Montana, during a 5-year infestation period. The survey also showed that a total net growth loss of 19.6 board feet per acre occurred during this 5-year period 1967-72. Significant loss also occurred to Christmas tree production and sales because of budworm defoliation.

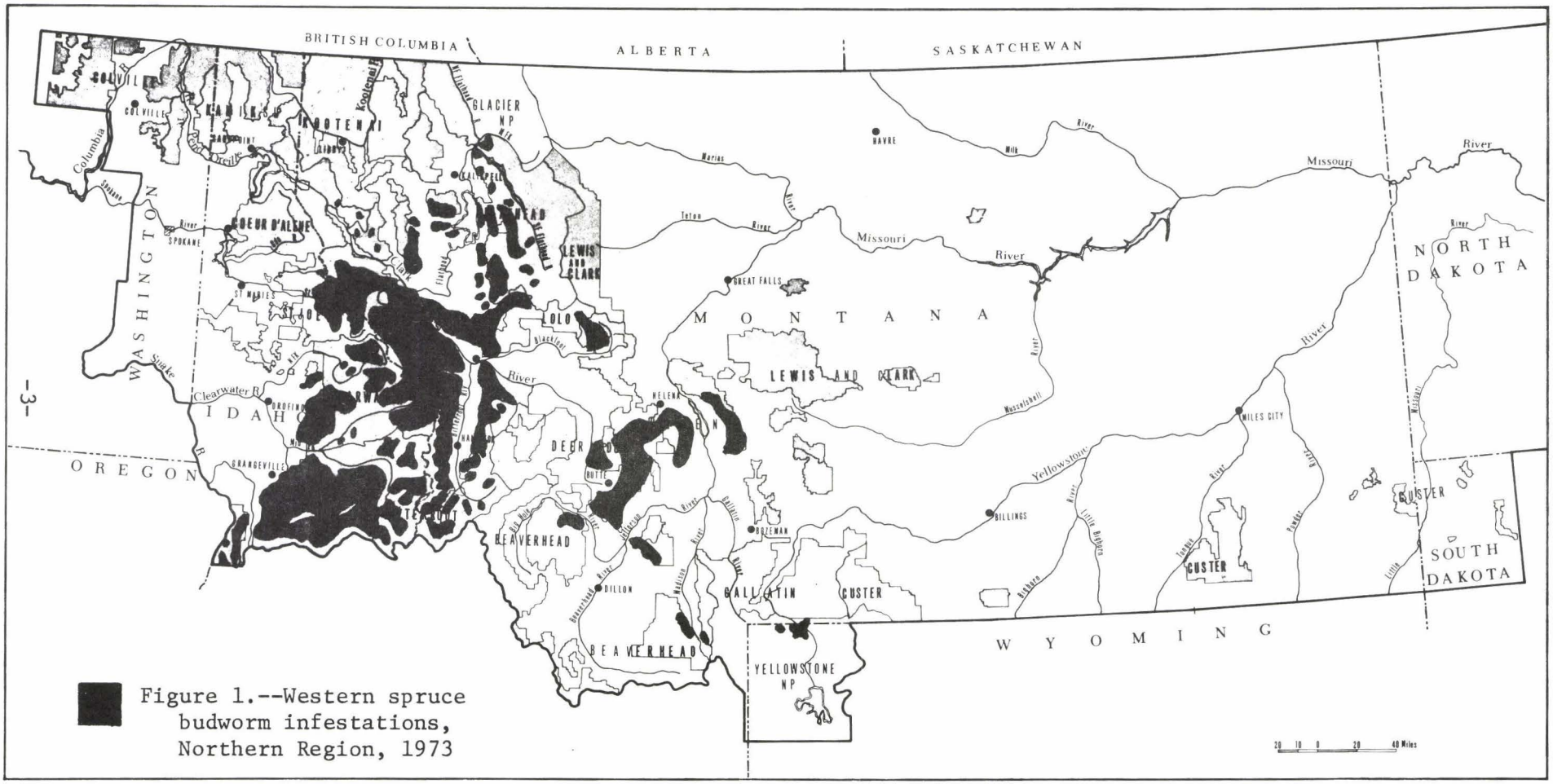

Figure 1.--Western spruce budworm infestations, Northern Region, 1973

Defoliation intensity and acreage infested increased in the Bitterroot National Forest and on the west half of the Lolo National Forest in western Montana. New infestation occurred in scattered patches from Munson Creek to Winniemuck Creek on the Thompson Falls Ranger District, Lolo National Forest, Montana.

Aerially visible defoliation remained at about 1.3 million acres on the Nezperce National Forest, and over 400,000 acres had visible defoliation on the Clearwater National Forest, Idaho. Prolonged feeding for several years has caused extensive top kill and tree mortality on these two Forests and on the Lolo and Flathead National Forests in western Montana. Budworm feeding has affected regeneration programs on these Forests by virtually eliminating the seed source in many areas. Cones have been destroyed by direct feeding and indirectly by the trees being weakened by repeated defoliation to where they fail to produce a cone crop. As a result, the Clearwater, Lolo, and Nezperce National Forests are contemplating establishing seed orchards for affected host species to be closely managed for regeneration purposes. It may be necessary to periodically aerially or ground spray these areas to protect them from budworm damage. A three-stage impact survey is underway to determine growth loss and net impact occurring within infested stands on the Nezperce National Forest.

The greatest increase in acres of defoliation and intensity of damage occurred on the Red Ives Ranger District, Idaho Panhandle National Forests, where the outbreak spread from 86,500 acres in 1972 to 146,000 acres in 1973. Defoliation varied from light to heavy, and considerable top killing is now occurring in this area.

Severe damage is expected in western portions of the Region in 1974. Intensity of defoliation and acreage infested may increase in some east side Forests also.

DOUGLAS-FIR TUSSOCK MOTH, *Orgyia pseudotsugata* McD.--The Douglas-fir tussock moth outbreak mushroomed from small localized infestations to approximately 104,550 acres in Idaho in 1973 (fig. 2). The largest concentrated area of defoliation was 70,000 acres in mixed Douglas-fir grand fir stands on State and private lands and on the Palouse Ranger District, Idaho Panhandle National Forests. In this area, many trees were partially denuded in 1 year of heavy feeding (fig. 3).

In June 1973, the State of Idaho Department of Public Lands, Union Carbide Corporation, and the U.S. Forest Service conducted a pilot test of Sevin-4-oil (Carbaryl) to control Douglas-fir tussock moth populations. The insecticide was sprayed by helicopter at the rate of 1 pound per acre in one-half gallon of No. 2 diesel oil on three 60-acre plots in Benewah and Latah Counties, Idaho. Results showed an average of 70 percent population reduction. Significant amounts

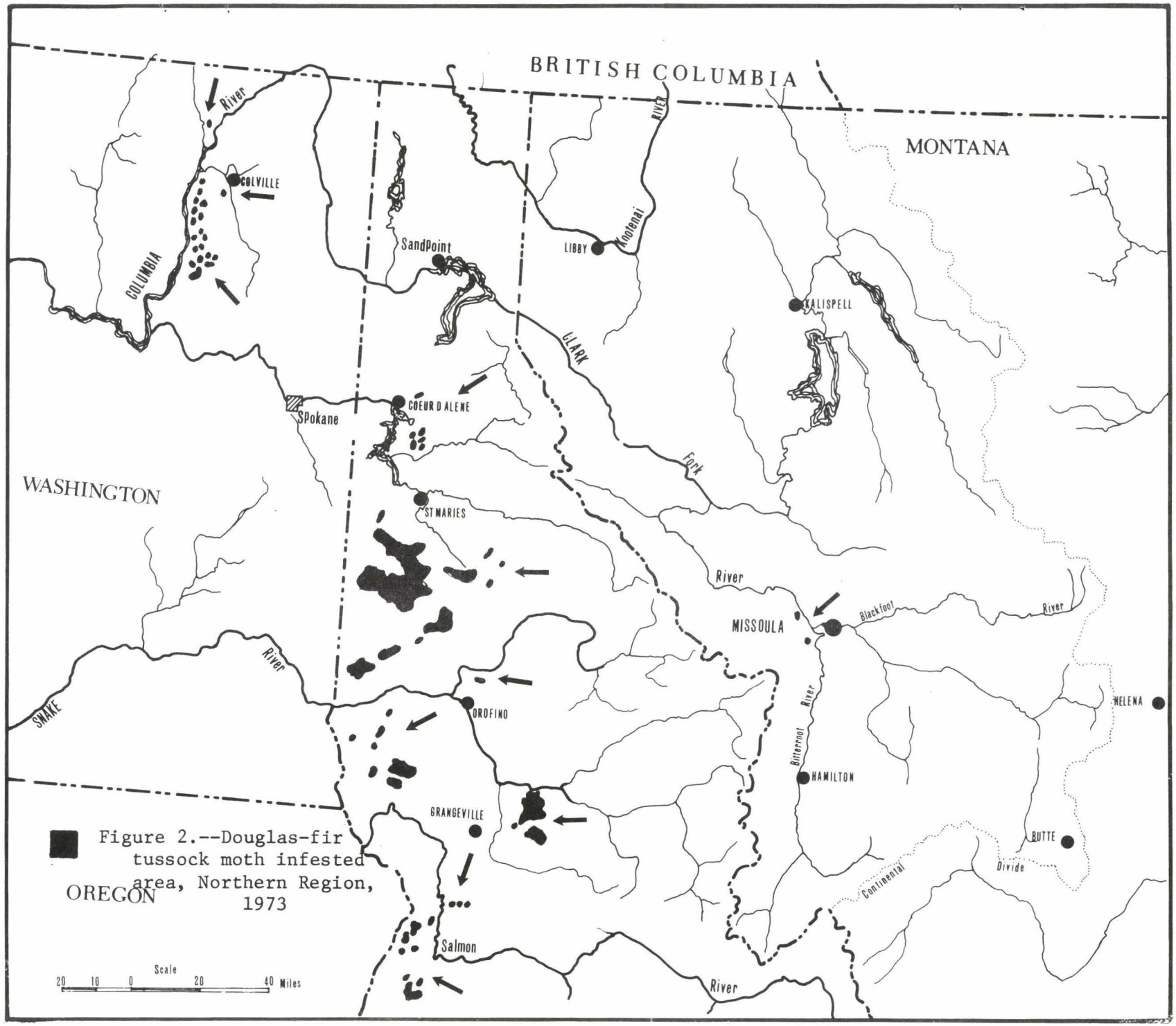

Figure 2.--Douglas-fir tussock moth infested area, Northern Region, 1973

of foliage were saved when sprayed blocks were compared to untreated check blocks. Tussock moth populations in these plots were relatively low (50 to 80 insects per 1,000 square inches of foliage) in comparison to populations reported in other infestations.

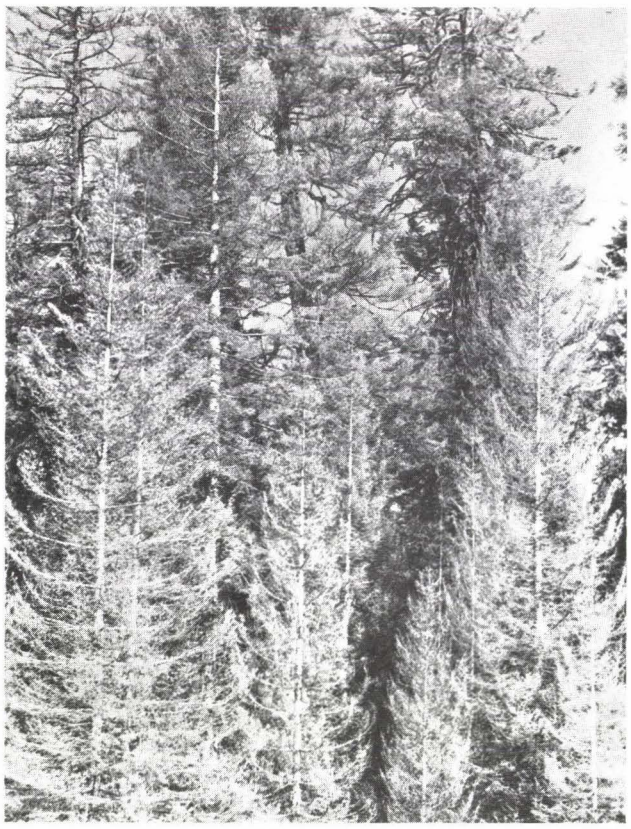

Figure 3.--Stand defoliated by Douglas-fir tussock moth, 1973.

Defoliation of 23,000 acres of mixed Douglas-fir, grand fir occurred in the Selway and Salmon River Ranger Districts on the Nezperce National Forest, Idaho. Localized Douglas-fir stands suffered heavy defoliation on the Salmon River Ranger District near Riggins, Idaho, in 1973.

Aerially visible defoliation of 5,200 acres occurred on private lands along the Columbia River in northeastern Washington. Defoliation varied from light to moderate throughout this infested area.

Four thousand acres of mixed Douglas-fir, true fir stands received moderate to severe defoliation on State, private, and Forest Service lands in the Craig Mountains south of Lewiston, Idaho. One area of 5 acres was heavily defoliated near Johnson's Mill on the Clearwater National Forest in Idaho.

Two small areas of mixed reproduction and pole size Douglas-fir (50 acres in Worden Creek, 300 acres near Frenchtown, Montana) were heavily defoliated in 1973. Complete defoliation occurred on some trees, and some heavily damaged trees may not recover. Surveys conducted in these two areas during late fall 1973 found sufficient egg masses to cause heavy defoliation in 1974. However, these infestations are not expected to spread significantly from their present areas as few new egg masses were detected outside the present infested perimeter. Other spot infestations may appear in western Montana in 1974, but these cannot be detected at the present time.

Surveys conducted in Idaho showed a sufficiently high number of egg masses to result in heavy defoliation in many areas in 1974. Significant tree mortality is expected in stands severely defoliated in 1973.

Plans are being developed to pilot test two microbial insecticides, *Bacillus thuringiensis* Ber., and a naturally occurring polyhedrosis virus in 1974.

LARCH CASEBEARER, *Coleophora laricella* (Hbn.).--Larch casebearer damage was heaviest in western larch stands below 3,000 feet elevation where up to 100 percent of the needles were destroyed in some northern Idaho areas. Moderate to heavy foliar damage occurred to larch stands around Flathead Lake, Columbia Falls, and in the Swan Valley in northwestern Montana. An imported parasite, *Chrysocharis laricinellae* (Ratz.), was released to establish this parasite as a biological control agent in selected larch stands near Moscow, Idaho, and near Evaro, Montana (fig. 4). Release sites will be evaluated in 1974 to determine if this parasite did become established.

Figure 4.--Release of *Chrysocharis laricinellae* to control larch casebearer.

PINE BUTTERFLY, *Neophasia menapia* F. and F.--Infestations on the Bitterroot and Lolo National Forests in western Montana and the Nezperce National Forest in Idaho declined by the end of 1973. Egg and larval predation by pentatomids, poor egg viability, pupal parasitism, and starvation due to depletion of needles by heavy larval populations were significant factors responsible for the population decline. The most significant parasites responsible for population decline are an ichneumonid, *Theronia atlantae fulvescens* (Cr.), and a sarcophagid, *Agria housei* Shewell. The chemical Zectran and the biological agent *Bacillus thuringiensis* Ber. (*B.t.*) were field tested against the pine butterfly in 1973. Two concentrations of each material (Zectran 0.15 pound per gallon per acre and 0.30 pound per gallon per acre; *B.t.* one-half pound per 2 gallons per acre and 1 pound per 2 gallons per acre were applied by helicopter (fig. 5).

Figure 5.--Helicopter applying Zectran for control of pine butterfly populations, Bitterroot National Forest, Montana, 1973.

Each treatment, except the one-half pound *B.t.*, gave over 90 percent population reduction. Both materials are good candidates for pilot testing. Egg mass surveys indicate light to negligible defoliation is expected in the Bitter Root Valley in 1974.

WESTERN FALSE HEMLOCK LOOPER, *Nepytia freemani* Mun.--This defoliator reached epidemic proportions for the first time since 1964 in the Northern Region. Light defoliation was observed in the upper crown of Douglas-fir trees on about 3,500 acres around the north end of Flathead Lake near Bigfork and Somers, Montana. Some tachinids (*Cermoasia auricaudata* Tns.) and ichneumonids (*Phobocampe* sp. and *Apechthis* sp.) were observed parasitizing larval and pupal populations in August 1973.

WESTERN HEMLOCK LOOPER, *Lambdina fiscellaria lugubrosa* Hulst.--Infestations declined in areas defoliated in 1972, but 11,200 acres of mountain hemlock received light defoliation on the Canyon Ranger District, Clearwater National Forest, in 1973. Larvae were common throughout much of the Douglas-fir tussock moth infested stands in Latah and Benewah Counties, Idaho. Infestations are expected to remain at about the same level or decline in 1974.

A PINE SAWFLY, *Neodiprion nanulus contortae* Ross.--Larval populations of this sawfly caused moderate to heavy defoliation of lodgepole pine and ponderosa pine reproduction on 10,000 acres of Kootenai National Forest and private land, West Fork Fisher River drainage, Montana. Heaviest damage occurred in naturally seeded areas on trees 20 feet or less in height. Egg surveys conducted in October indicate a population decline in 1974.

DEFOLIATOR COMPLEX.--A needle miner, *Ocnerostoma strobivorum* Freeman; the pine needle sheath miner, *Zelleria haimbachi* Busck.; and the sugar pine tortrix, *Choristoneura lambertiana* (Busck.), caused defoliation of lodgepole pine on 5,000 acres in an area from Teakettle Mountain on the Glacier View Ranger District, Flathead National Forest, to McDonald Lake in Glacier National Park, Montana. Two-year and older needles were mined by the needle miner, while the pine needle sheath miner and sugar pine tortrix defoliated new growth. A study was conducted in the Teakettle Mountain-Glacier National Park area to determine impact of these insects and fluoride emitted from nearby aluminum reduction plant on lodgepole pine stands. Populations of the pine needle sheath miner and the needle miner were significantly correlated with degree of fluoride found in the air and in needle tissue, suggesting fluorides have predisposed lodgepole pine to attack by these insects.

BRUCE SPANWORM, *Operophtera bruceata* (Hulst).--More than 15,650 acres of quaking aspen in the Turtle Mountains of North Dakota were defoliated by this insect during the spring of 1973.

Major Bark Beetle Problems

Mountain pine beetle, *Dendroctonus ponderosae* Hopk.--The number of western white, lodgepole, and ponderosa pines killed by the mountain pine beetle in 1973 increased over 1972 (figs. 6 and 7). Most white pine mortality occurred on private and State of Idaho lands in the North Fork Clearwater River drainage.

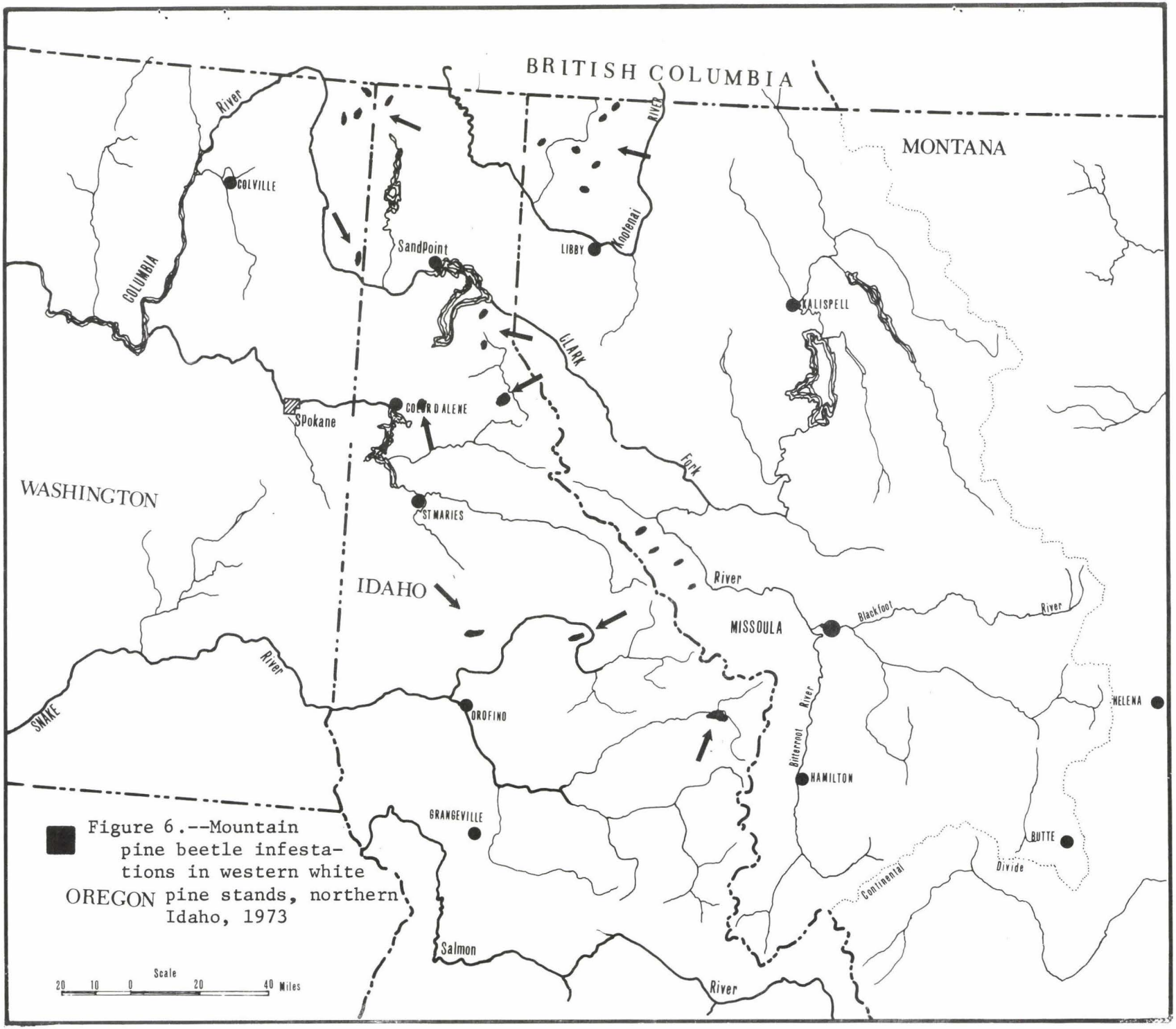

Figure 6.--Mountain pine beetle infestations in western white pine stands, northern Idaho, 1973

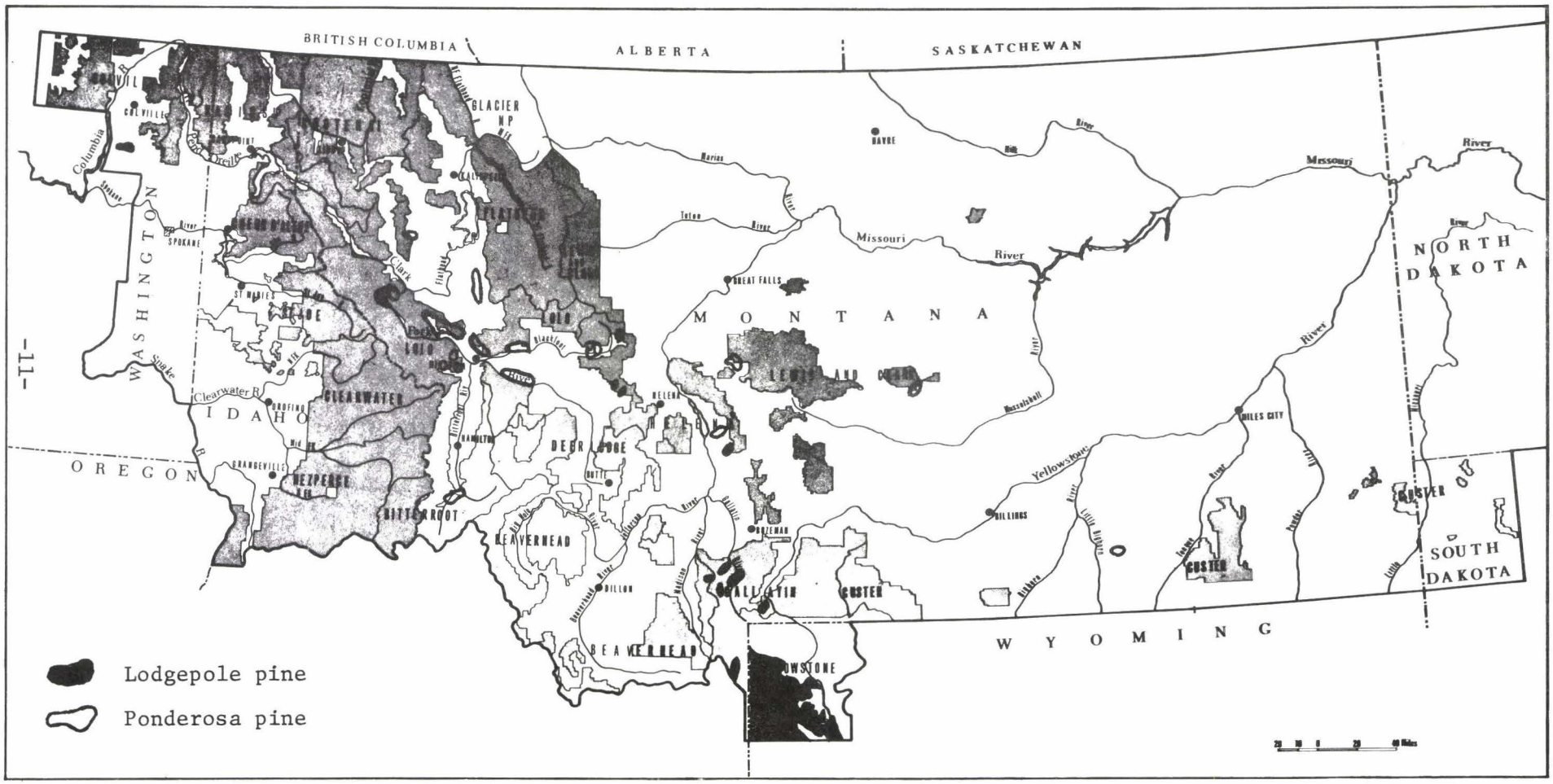

Figure 7.--Mountain pine beetle infestations in lodgepole and ponderosa pine stands, Montana, 1973.

Forest inventory plots established by Potlatch Forests, Inc., personnel in Idaho, in the Pierce-Headquarters area, show the trend is declining and gave an insect-caused net board foot mortality of 2.04 percent per year from 1967-73. This was 77 percent of the total pine mortality; the remainder was due to disease and other factors on private ownership in the North Fork Clearwater River drainage.

Active infestations occurred in Yellow Dog and Downey Creek drainages of the Coeur d'Alene River. New infestations appeared in the Sullivan Creek drainage east of Sullivan Lake in the Idaho Panhandle National Forests. Chronic infestations continue in stands infected with white pine blister rust (*Cronartium ribicola* Fisch.) in north Idaho.

Mountain pine beetle populations expanded in second-growth ponderosa pine stands in the Ninemile drainage, Lolo National Forest, Montana. Surveys of these stands show a decrease in number of infested trees in 1973.

Commercial thinnings of approximately 1,200 acres of second-growth infested stands are in progress on the Ninemile Ranger District to determine the feasibility of this stand management practice for preventing mountain pine beetle attack. One 15-acre block (fig. 8) thinned in 1970 has been free of mountain pine beetle infestation since thinning. Adjacent unthinned stands have a current infestation level ranging from 0 to 23 trees per acre. The outbreak is expected to continue at epidemic level in 1974.

New outbreaks developed to epidemic levels in 60- to 80-year-old second-growth ponderosa pine stands along the Clark Fork River on Bureau of Land Management, National Forest, and private lands between Lyon Gulch and Turah, Montana, in 1973. Many trees within these stands were killed by *Ips pini* Say and *Ips plastographus* (Lec.). Several hundred pine were also killed in the Blackfoot River drainage east of Missoula, Montana, and also in second-growth ponderosa pine stands between St. Ignatius and Flathead Lake on the Flathead Indian Reservation in western Montana.

Epidemic infestations occur in mixed ponderosa pine, Douglas-fir stands in Corral, Thompson, and Cache Creek drainages on the Crow Indian Reservation in southeastern Montana. Surveys of 162 infested acres during fall 1973 show 3,175 trees are infested containing 280,000 board feet. Average buildup of old to newly attacked trees was 1:4 from 1972 to 1973. Only scattered infested tree groups occur in the Cache and Little Corral Creek drainages. Salvage sales are planned to reduce number of infested trees prior to beetle flight in 1974.

Mountain pine beetle reached near epidemic levels in lodgepole pine stands in the Sulphur Creek-Black Butte area in the Big Belt Mountains, Townsend Ranger District, Helena National Forest, Montana. Evaluations show infestations in these areas are static with a decreasing trend.

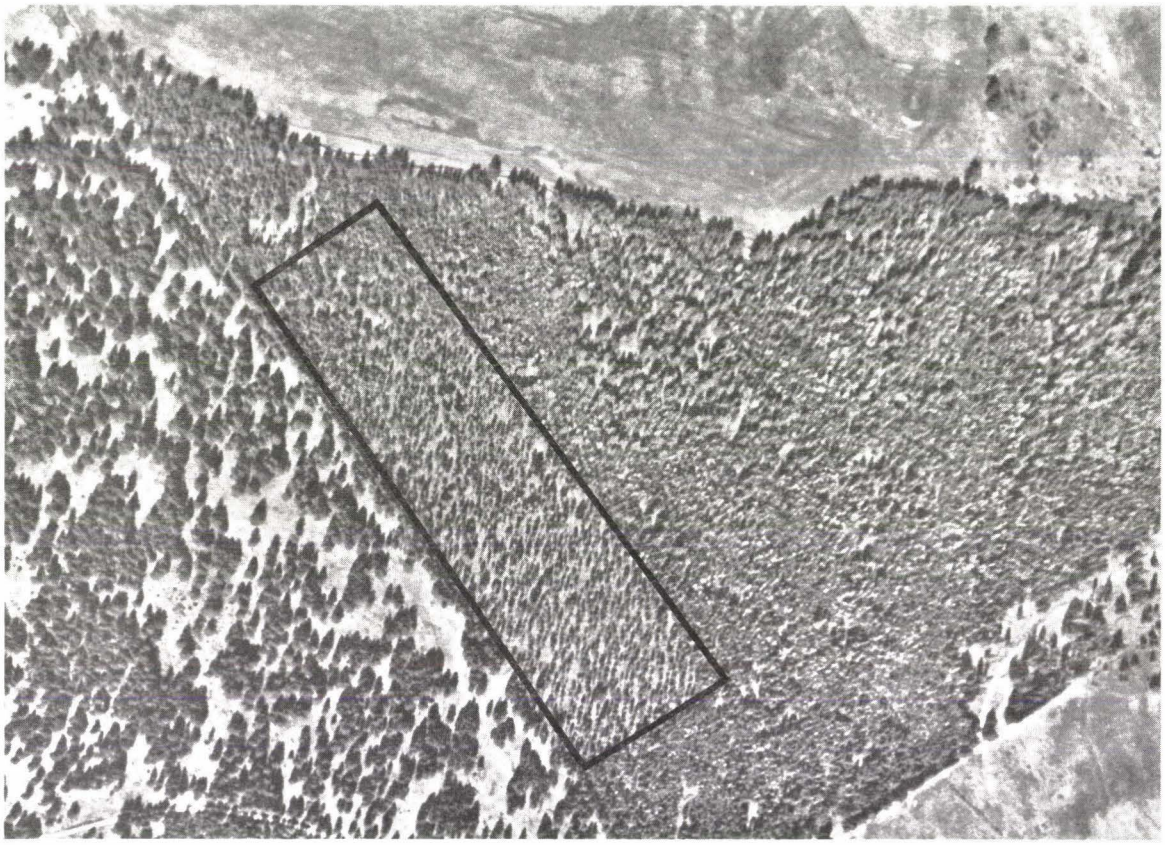

Figure 8.--Fifteen-acre block thinned as a silvicultural control for mountain pine beetle in second-growth ponderosa pine stands, Ninemile Ranger District, Lolo National Forest, Montana. Note abundance of light-colored crowns (red tops) in adjacent outlined portion.

Woodpeckers stripped many trees of bark directly killing bark beetle broods and exposing others to adverse weather factors, contributing to the population decline in the Sulphur Creek drainage. However, many trees in the Sulphur Creek drainage remain susceptible since they have been girdled by porcupines and attacked by *Ips* sp. and *Pityogenes* sp. Many trees partially attacked by these bark beetles are being attacked by mountain pine beetle. Other infestations occur in second-growth ponderosa pine stands on mixed State, private, and Federal lands near Marysville, Unionville, and Lump Gulch near Helena, Montana. Scattered groups of second-growth ponderosa pine were killed by mountain pine beetle and pine engraver beetle, *Ips pini* and *Ips plastographus* on State, private, and Bureau of Land Management lands in the North Fork of Roy and Grunett Creek drainages near Canyon Ferry Reservoir east of Helena, Montana. Beetle populations in these drainages appeared to have built up in blowdown that occurred during winter 1972-73. Newly attacked trees were on dry, rocky sites. With the drought experienced in 1973,

trees were probably stressed and were more susceptible to bark beetle attack. Additional trees stressed by drought in 1973 may be attacked in 1974.

Epidemic conditions persist in lodgepole pine stands in the West Gallatin River drainage, Gallatin National Forest, Montana; Yellowstone National Park, Wyoming; Glacier National Park, Montana; and on the Lincoln Ranger District, Helena National Forest. Surveys are in progress to determine current infestation levels and volume loss in the West Gallatin River infestation.

A new outbreak developed in the Yaak River drainage, Yaak Ranger District, Kootenai National Forest, Montana. An epidemic infestation occurs in ponderosa pine stands in the West Fork Bitterroot River drainage, Bitterroot National Forest, Montana. Small infested groups of ponderosa pine were detected throughout the Lewis and Clark National Forest, Montana.

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae* Hopk.--Ground surveys and population sampling showed that the massive outbreak in the North Fork Clearwater River drainage near Orofino, Idaho, declined sharply in 1973, with an estimated 4,202,110 board foot volume being killed. Infested tree groups were significantly smaller than occurred in 1971 and 1972. The decline is expected to continue in 1974. New infestations developed along the St. Joe River in the Idaho Panhandle National Forests and in Fish Creek drainage, Middle Fork of Clear Creek, and in major tributaries of the South Fork Clearwater River, Nezperce National Forest, Idaho; also in tributaries of the Clark Fork River east of Missoula, Montana, and in the East Fork Bitterroot River drainage, Bitterroot National Forest, Montana. Beetle activity declined to a low level in trees weakened by winter drying in the Bridger Mountains, Gallatin National Forest, Montana. The extreme dry season experienced in 1973 may weaken trees and precipitate increased beetle activity in 1974.

PINE ENGRAVER BEETLES, *Ips* spp.--Infestations increased in many ponderosa pine forests of the Region, probably because of the severe drought experienced in 1973. New outbreaks developed in the Garnet Mountain Range along the Clark Fork River from Drummond downstream to St. Regis, Montana, and several thousand ponderosa pine were killed on the Flathead Indian Reservation in Montana. Minor beetle activity was observed on the Slate Creek Ranger District, Nezperce National Forest, Idaho. *Ips* spp. associated with mountain pine beetle top killed ponderosa pine in many forests of western Montana. Logging activity promoted *Ips* buildup resulting in mortality in ponderosa pine stands at several localities near Deary, Idaho. Extensive mortality is expected in many forests in 1973.

FIR ENGRAVER BEETLE, *Scolytus ventralis* Lec.--Most severe tree mortality occurred in grand fir stands near Coeur d'Alene Lake and on the Mica, Fernan, and Wallace Ranger Districts, Idaho Panhandle National Forests.

Many fir engraver infestations were associated with root rot centers. Tree killing decreased in grand fir stands on the Clearwater Ranger District, Nezperce National Forest, Idaho. New infestations developed in Douglas-fir adjacent to cutover areas in the Big Belt Mountains, Townsend Ranger District, Helena National Forest, Montana. Infestations are expected to continue at epidemic levels in 1974.

OTHER INSECTS.--A Douglas-fir engraver beetle, *Scolytus tsugae* (Sw.), killed and top killed several hundred Douglas-fir around Dworshak Reservoir near Orofino, Idaho. Lower bole sections of top-killed trees were attacked by Douglas-fir beetle and the California flatheaded borer, *Melanophila drummondi* (Kirby). Extremely dry weather conditions experienced this year may stress trees and result in increased tree killing by *M. drummondi* in 1974. The variable oak leaf caterpillar, *Heterocampa manteo* (Dbldy.), caused light, widely scattered defoliation of paper birch, American basswood, and burr oak in the Killdeer and Turtle Mountains and on the Fort Totten Indian Reservation in North Dakota. The white pine weevil, *Pissodes strobi* Peck, top killed spruce reproduction in open-grown spruce stands throughout the Region. Damage is expected to increase as cutover areas are regenerated with spruce. The California tortoise shell butterfly, *Nymphalis californica* Boisduval, defoliated 1,200 acres of shiny leaf ceanothus near Seeley Lake, Montana, and in the Sundance burn in north Idaho. The forest tent caterpillar, *Malacosoma disstria* Hbn., defoliated birch, hawthorn, and other broadleaf species along river bottoms near Coeur d'Alene and St. Maries, Idaho, and the Jocko River in Montana, and elms in the city of Billings, Montana. The flea beetle, *Altica bimarginata* Say, completely defoliated alder on several hundred acres along the Lochsa River in northern Idaho. Feeding by nymphs and adults of a lacebug, *Corythucna scitula* Drake, caused yellowing of leaves and early leaf drop of alder on the Kelly Creek and Canyon Ranger Districts, Clearwater National Forest, Idaho. The rusty tussock moth, *Orgyia antiqua* (Linn.), defoliated numerous browse species on the Clearwater National Forest, Idaho, and Lolo National Forest, Montana. Cooley spruce gall aphid, *Adelges cooleyi* (Gillette), caused yellowing of needles of reproduction and pole size Douglas-fir throughout much of the Flathead National Forest and in widely scattered areas of the Lolo National Forest, Montana. The spring cankerworm, *Paleacrita vernata* (Peck.), continued to cause noticeable defoliation of Siberian elm shelterbelts in North Dakota. Fall cankerworm, *Alsophila pometaria* Harr., defoliated green ash in the North Dakota badlands.

STATUS OF FOREST DISEASE

Conditions in Brief

Root decay fungi, *Poria weirii* and *Armillaria mellea*, were found causing mortality in young Douglas-fir, ponderosa pine plantations, and *Fomes annosus* was found contributing to mortality in 200- to 300-year-old ponderosa pine stands. Dwarf mistletoe control accomplishments were decreased due to withdrawal of funds. Annual impact of dwarf mistletoes on the Flathead Indian Reservation has been estimated to be $123,750. In general, foliage diseases were spotty in occurrence and locally severe in certain areas. Elytroderma needle blight was probably the most damaging foliage disease. At the Coeur d'Alene nursery significant numbers of dead spruce, grand fir, and Douglas-fir seedlings were colonized by root pathogens. Losses were as high as 30 to 40 percent in some beds.

Noninfectious (abiotic diseases) were prominent during 1973. Approximately 13,500 acres in the Blackfoot Valley of Montana were subject to winter injury. Drought symptoms were noted on several coniferous species, particularly in northern Idaho. Air pollutants were implicated as causing damage to approximately 5,000 acres of Douglas-fir around Missoula, Montana, and to vegetation near Butte, Montana. A significant growth reduction of lodgepole pine caused by an air pollutant-insect complex was measured near Columbia Falls, Montana.

Status of Diseases

ROOT DISEASES.--Remote sensing techniques have been found to be highly reliable in the detection of root disease centers in some stands in the Idaho Panhandle National Forests. As much as 70 percent of some of these stands are visibly affected by root disease (fig. 9).

Utilizing remote sensing techniques, a root disease impact survey is currently being conducted on the Coeur d'Alene National Forest portion of the Idaho Panhandle National Forests. Although a complex of at least seven fungi is apparently involved, the most abundant pathogens seem to be *Poria weirii* (Murr.) Murr. and *Armillaria mellea* (Vahl ex Fr.) Kumm. (fig. 10).

Armillaria mellea and *Fomes annosus* (Fr.) Cke. were found contributing to mortality in 200- to 300-year-old ponderosa pine in the Lone Pine area of the Flathead Indian Reservation. Numerous overmature ponderosa pine have been dying in the area for several years, and in many cases mortality was attributed to western pine beetle, *Dendroctonus brevicomis* (Lec.). Several 1973 faders containing beetles were bulldozed over and roots examined. In one case, advanced decay caused by *Fomes annosus* was found in over 90 percent of the tree's roots. However, in

Figure 9.--Root disease centers (light gray) as they appear in the fall when shrubs in centers have turned yellow and red in contrast with the green canopy (dark gray) of unaffected conifers. A complex of fungi involving *Poria weirii* is responsible for the centers.

Figure 10.--Laminated root rot of grand fir. *Poria weirii* alone or in combination with one to six other decay fungi causes this type of damage in northern Idaho.

another case, only minor amounts of *Armillaria mellea* were present (fig. 11).

Figure 11.--Mature ponderosa pine with over 95 percent of its roots decayed by *Fomes annosus*. The tree had also been attacked by western pine beetle.

On the Selway Ranger District of the Nezperce National Forest, approximately 3,000 acres of young, mixed composition (primarily Douglas-fir) plantations were inventoried for information including mortality caused by root disease. *Armillaria mellea* was found killing ponderosa pine saplings, while *Poria weirii* was found killing Douglas-fir and grand fir seedlings and saplings. Although survey data are not available at this time, observations indicate that insignificant mortality caused by root pathogens is occurring.

STEM DECAYS.--Isolations made from subalpine fir, Engelmann spruce, and Douglas-fir which had been scarred during a selective logging operation 10 years ago yielded *Stereum sanguinolentum* (Alb. and Schw. ex Fr.) Fr. in nearly all cases. Although only a relatively few wounds were evaluated, these preliminary results indicate that care should be taken to avoid wounding residual trees in selective cutting operations.

DWARF MISTLETOES, *Arceuthobium* spp., were controlled on approximately 4,000 acres. More acreage would have been worked, but some of the allotted funds were withdrawn to combat insect outbreaks in other Regions.

Data from inventory plots in Douglas-fir and western larch stands on the Flathead Indian Reservation show an annual loss to dwarf mistletoes

of $0.63 per acre. Expanding this to the entire reservation gives an annual loss of $123,750.

DUTCH ELM DISEASE, *Ceratocystis ulmi* (Buism.) C. Moreau, was recovered from one American elm in Missoula, Montana. This is the first record of the occurrence of this pathogen in Montana. The fungus was also recovered from American elm in the Bismarck, Mandan, and Fargo areas of North Dakota.

NEEDLE CASTS.--*Elytroderma deformans* (Weir) Darker was particularly severe on ponderosa pine in the Bitter Root Valley and Flathead Valley of Montana. Much new infection was observed. It was found to be of widespread occurrence primarily on ponderosa pine but also on lodgepole pine in northern Idaho (fig. 12).

Figure 12.--Defoliation and brooming caused by *Elytroderma deformans* on ponderosa pine.

Lophodermella arcuata (Darker) Darker was of localized occurrence in the Coeur d'Alene River and Hayden Creek drainages of the Idaho Panhandle National Forests.

Lophodermium pinastri (Schrad. ex Fr.) Chev. caused minor defoliation of natural ponderosa pine in isolated areas of the Flathead Indian

Reservation near Arlee, Montana, and in the Hayden Creek area of the Idaho Panhandle National Forests. This fungus, or one very close to it, is causing moderate defoliation of planted ponderosa pine in areas of the Idaho Panhandle National Forests near Bonners Ferry, Idaho, and also in the Hayden Creek area.

Lophodermella concolor (Dearn.) Darker was locally heavy on lodgepole pine in areas of the Colville National Forest east of Colville, Washington, and in the Hellroaring Creek area of the Bitterroot National Forest in Montana.

Rhabdocline pseudotsugae Syd. caused severe defoliation of Douglas-fir in the Lochsa River drainage, but was infrequently found elsewhere.

NEEDLE RUSTS.--Needle rusts, *Pucciniastrum* spp., were found on grand fir in the Beauty Creek, Rutherford Gulch, and Boundary Peak areas of the Idaho Panhandle National Forests (fig. 13). Seedlings and saplings were moderately affected with up to 50 percent of current year's foliage damaged in some cases.

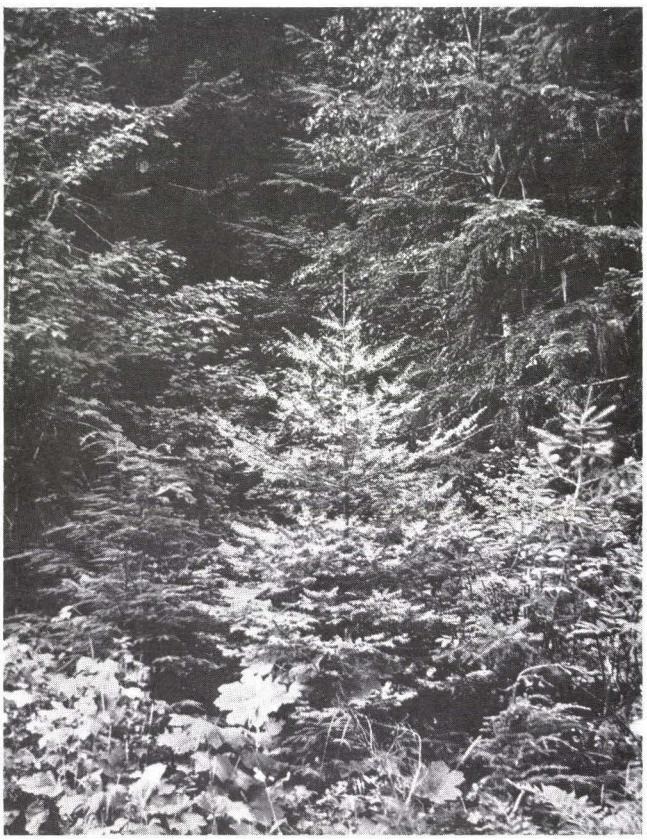

Figure 13.--Needle rust (*Pucciniastrum* sp.) of grand fir. Light gray needles have been killed by the rust organism.

OTHER FOLIAGE DISEASES.--*Lecanosticta* sp. (needle blight of western white pine) caused severe defoliation of western white pine in localized areas of the Priest River and Coeur d'Alene River drainages of the Idaho Panhandle National Forests. In many cases the lower one-third of the crowns of affected trees was completely defoliated, probably due to a combination of suppression and the fungus.

Red band needle blight, caused by *Scirrhia pini* Funk and Park, was of moderate but declining severity in ponderosa pine stands in the Lochsa River and Priest River drainages.

NURSERY DISEASES.--Seedling losses at the Coeur d'Alene nursery were 30 to 40 percent or higher in some nursery beds. Affected were 2-0 Engelmann spruce and 1-0 Douglas-fir and grand fir. Isolations made from dead and dying seedlings yielded a high percentage of two or more *Fusarium* spp. Although known pathogens were found in the affected seedlings, their presence is probably due to improper nursery bed conditions and are probably not the sole cause of mortality.

Winter injury was especially severe on 2-0 spruce in the nursery, but trees generally recovered and grew rapidly during the summer. No correlation between winter injury and incidence of root pathogens was evident (fig. 14).

Figure 14.--Winter and frost damage to 1-0 Douglas-fir in the Coeur d'Alene nursery.

DROUGHT.--Various amounts of abnormal defoliation of western redcedar, grand fir, and ponderosa pine were observed in the Idaho Panhandle National Forests. This defoliation is probably due to the drought conditions which occurred during the winter of 1972-73 and hot, dry conditions which occurred during the summer of 1973. Western redcedar was severely affected in some areas and may result in a minor amount of mortality.

WINTER DAMAGE (RED BELT).--In the Blackfoot Valley of western Montana, aerial surveys supported by ground observations showed that 13,500 acres of ponderosa pine were damaged by cold or dehydration during the winter of 1972-73. Damage on 12,340 acres was classified as light, 800 acres as moderate, and 360 acres as severe. Douglas-fir was not affected. Very light damage to ponderosa pine was noticed in other parts of western Montana, including the Clark Fork Valley east and west of Missoula, the Bitter Root Valley, and the Flathead Valley. Trees are not expected to die (fig. 15).

Figure 15.--Winter damage to terminals of ponderosa pine in the Blackfoot Valley.

POLE BLIGHT.--Previously found only in natural western white pine stands, pole blight has been identified by Intermountain Forest and Range Experiment Station pathologists in several 35- to 40-year-old western white pine plantations around Deception Creek on the Idaho Panhandle National Forests.

AIR POLLUTANTS.--A diseased condition of Douglas-fir was noted in February 1973 adjacent to a paper mill which emits large amounts of reduced sulfur and moderate amounts of sulfur dioxide near Missoula, Montana. The 2-year and older foliage had developed partial (tip) to complete necrosis (fig. 16). An aerial survey was made and visible injury was found over 5,000 acres of Federal, State, and private lands.

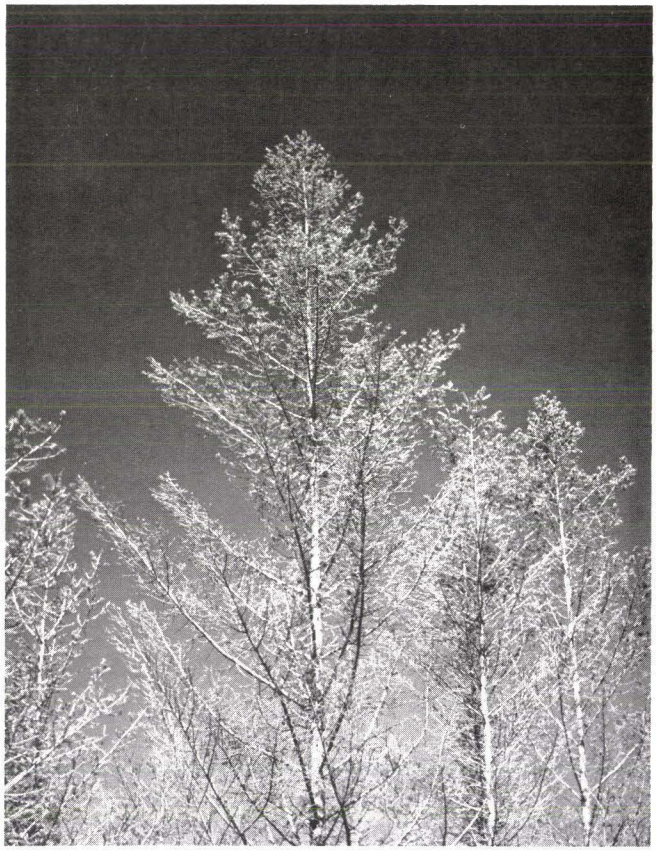

Figure 16.--Moderately defoliated Douglas-fir near Missoula, Montana. Defoliation most likely resulted from exposure to excessive amounts of sulfur.

It was concluded that neither insects nor pathogenic fungi were responsible. Winter damage as a cause was also ruled out. Sulfur concentrations in affected tissue reached as high as 30 times that found in needles from control areas. High amounts of total sulfur and considerable sulfur dioxide were found in the air within the affected area. The most probable explanation of cause was determined to be excessive sulfur in the reduced and oxidized forms. Histological analyses of needle tissue supported this conclusion.

An estimated total merchantable volume of 3,108,891 board feet was affected: 672,205 board feet (22 percent) were in the none-to-lightly affected category; 1,779,469 board feet (57 percent) were in the moderate; and 657,217 board feet (21 percent) were in the severe category. Few of the trees were dead. If fumigation continues as is expected, considerable mortality will occur.

Clinical effects of fluorides emitted from the Anaconda aluminum plant at Columbia Falls, Montana, have been documented. Data from Stage II examination of 22 separate stands in the area showed a rather consistent significant reduction in growth attributable to the fluoride-insect complex present in the area. This reduction was independent of site or weather factors. The impact in terms of board foot loss has not yet been calculated.

A chemical plant producing elemental phosphorous near Butte, Montana, emits hydrogen fluoride. Although little fluoride injury was found on vegetation during a detection survey around the facility, the amounts accumulated by plants represent a threat to foraging animals that consume that vegetation.

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